

CLAIMS

1. A highly corrosion resistant high strength stainless steel pipe for linepipe having a composition comprising: 0.001 to 0.015% C, 0.01 to 0.5% Si, 0.1 to 1.8% Mn, 0.03% or less P, 0.005% or less S, 15 to 18% Cr, 0.5% or more and less than 5.5% Ni, 0.5 to 3.5% Mo, 0.02 to 0.2% V, 0.001 to 0.015% N, and 0.006% or less O, by mass, so as to satisfy the formulae (1), (2), and (3), and balance of Fe and impurities,

$$\text{Cr} + 0.65\text{Ni} + 0.6\text{Mo} + 0.55\text{Cu} - 20\text{C} \geq 18.5 \quad (1)$$

$$\text{Cr} + \text{Mo} + 0.3\text{Si} - 43.5\text{C} - 0.4\text{Mn} - \text{Ni} - 0.3\text{Cu} - 9\text{N} \geq 11.5 \quad (2)$$

$$\text{C} + \text{N} \leq 0.025 \quad (3)$$

where C, Ni, Mo, Cr, Si, Mn, Cu, and N signify the content of the respective elements.

2. The high strength stainless steel pipe for linepipe according to claim 1, wherein the composition further comprises 0.002 to 0.05% Al by mass.

3. The high strength stainless steel pipe for linepipe according to claim 1 or claim 2, wherein the content of Ni is 1.5 to 5.0% by mass.

4. The high strength stainless steel pipe for linepipe according to any of claims 1 to 3, wherein the content of Mo is 1.0 to 3.5% by mass.

5. The high strength stainless steel pipe for linepipe according to any of claims 1 to 3, wherein the content of Mo is more than 2% and not more than 3.5% by mass.

6. The high strength stainless steel pipe for linepipe according to any of claims 1 to 5, wherein the composition further comprises 3.5% or less Cu by mass.

7. The high strength stainless steel pipe for linepipe according to claim 6, wherein the content of Cu is 0.5 to 1.14% by mass.

8. The high strength stainless steel pipe for linepipe according to any of claims 1 to 7, wherein the composition further comprises at least one element selected from the group consisting of 0.2% or less Nb, 0.3% or less Ti, 0.2% or less Zr, 0.01% or less B, and 3.0% or less W, by mass.

9. The high strength stainless steel pipe for linepipe according to any of claims 1 to 8, wherein the composition further comprises 0.01% or less Ca by mass.

10. The high strength stainless steel pipe for linepipe according to any of claims 1 to 9, wherein the composition further comprises a microstructure comprising 40% or less residual austenite phase and 10 to 60% ferrite phase, by volume, with martensite phase as a base phase.

11. The high strength stainless steel pipe for linepipe according to claim 10, wherein the ferrite phase is 15 to 50% by volume.

12. The high strength stainless steel pipe for linepipe according to claim 10 or claim 11, wherein the residual austenite phase is 30% or less by volume.

13. A method for manufacturing highly corrosion resistant high strength stainless steel pipe for linepipe comprising the steps of: making a steel pipe having a specified size from a steel pipe base material having a composition comprising 0.001 to 0.015% C, 0.01 to 0.5% Si, 0.1 to 1.8% Mn, 0.03% or less P, 0.005% or less S, 15 to 18% Cr, 0.5% or more and less than 5.5% Ni, 0.5 to 3.5% Mo, 0.02 to 0.2% V, 0.001 to 0.015% N, and 0.006% or less O, by mass, so as to satisfy the formulae (1), (2), and (3), and balance of Fe and impurities; reheating the steel pipe to 850°C or higher temperature; cooling the heated steel pipe to 100°C or lower temperature at a cooling rate of at or higher than air-cooling rate; and applying quenching and tempering treatment to the cooled steel pipe, to heat thereof to 700°C or lower temperature,

$$\text{Cr} + 0.65\text{Ni} + 0.6\text{Mo} + 0.55\text{Cu} - 20\text{C} \geq 18.5 \quad (1)$$

$$\text{Cr} + \text{Mo} + 0.3\text{Si} - 43.5\text{C} - 0.4\text{Mn} - \text{Ni} - 0.3\text{Cu} - 9\text{N} \geq 11.5 \quad (2)$$

$$\text{C} + \text{N} \leq 0.025 \quad (3)$$

where Cr, Ni, Mo, Cu, C, Si, Mn, and N signify the content of the respective elements.

14. The method for manufacturing high strength stainless steel pipe for linepipe according to claim 13 comprising the steps of: heating the steel pipe base material; making a steel pipe from the steel pipe base material by hot-working; cooling the steel pipe to room temperature at a cooling rate of at or higher than air-cooling rate, thus obtaining a seamless steel pipe having a specified size; and applying the quenching and tempering treatment to the seamless steel pipe.

15. The method for manufacturing high strength stainless steel pipe for linepipe according to claim 13 or claim 14, having the step of applying tempering treatment to heat the seamless steel pipe to 700°C or lower temperature instead of the step of quenching and tempering treatment.

16. The method for manufacturing high strength stainless steel pipe for linepipe according to any of claims 13 to 15, wherein the steel pipe base material has the composition of any thereof, further comprising 0.002 to 0.05% Al by mass.

17. The method for manufacturing high strength stainless steel pipe for linepipe according to any of claims 13 to 16, wherein the content of Ni is 1.5 to 5.0% by mass.

18. The method for manufacturing high strength stainless steel pipe for linepipe according to any of claims 13 to 17, wherein the content of Mo is 1.0 to 3.5% by mass.

19. The method for manufacturing high strength stainless steel pipe for linepipe according to any of claims 13 to 17, wherein the content of Mo is more than 2% and not more than 3.5% by mass.

20. The method for manufacturing high strength stainless steel pipe for linepipe according to any of claims 13 to 19, wherein the steel pipe base material has the composition of any thereof, further comprising 3.5% or less Cu by mass.

21. The method for manufacturing high strength stainless steel pipe for linepipe according to claim 20, wherein the content of Cu is 0.5 to 1.14% by mass.

22. The method for manufacturing high strength stainless steel pipe for linepipe according to any of claims 13 to 21, wherein the steel pipe base material has the composition of any thereof, further comprising at least one element selected from the group consisting of 0.2% or less Nb, 0.3% or less Ti, 0.2% or less Zr, 3.0% or less W, and 0.01% or less B, by mass.

23. The method for manufacturing high strength stainless steel pipe for linepipe according to any of claims 13 to 22, wherein the steel pipe base material has the composition of any thereof, further comprising 0.01% or less Ca by mass.

24. A welded structure fabricated by welding to join together the high strength stainless steel pipes according to any of claims 1 to 12.